FINAL REPORT

to the

Office of Naval Research

Contract Nonr-617(00)
Project NR 385 407

February 1954

The Beta Corporation
P. O. Box 8625
Richmond 26, Va.

CONTENTS

FINAL REPORT

1. SCOPE OF WORK

Under the terms of the contract the initial phases of work included but were not limited to:

"(a) the construction of test cells with means for applying direct and alternating pressures, measuring minute flow rates, and pressure differences arising as a result of applied electrode potentials,

(b) a compilation of data on the physical properties of selected organic and inorganic liquids believed to be suitable for electrokinetic energy conversion and a prediction of their electrokinetic properties for subsequent experimental checks,

(c) the testing of selected liquids in the cells constructed in (a) above to substantiate the predicted performance of (b) above,

(d) the construction of reversible test cells for the study of electrokinetic energy conversion and efficiency at high frequencies and the experimental determination of the efficiency of the cells as underwater ultrasonic signal detectors; and

(e) the compilation of a complete report containing the results of the above investigation, together with a comparison of electrokinetic, magnetostrictive, and piezoelectric energy conversion means as to their advantages and limitations."

Under the terms of a contract extension dated 30 November 1952, the final phase of the work included:

(f) " --- additional investigations of certain electrokinetic hydrophone phenomena ---".

Generally the direction of the work followed the phases outlined above, with details being planned from month to month as the work progressed, or after discussions with the Scientific Officer.

Phase (f) included the construction of four LF-1 Hydrophones, ten LF-2 Hydrophones, and one S-2 Hydrophone, all of which were shipped to various Naval activities or activities engaged in Navy work for tests and evaluation. These hydrophones are considered experimental, expendable items.

4. OUTLINE OF MATERIAL COVERED IN TECHNICAL REPORTS ON CONTRACT Nonr-617(00)

The work performed on Contract Nonr-617(00) has been fully described in Technical Reports 1, 2, 3, and 4; the latter including work up to the end of the contract. The phases of work listed above are partially covered in the various reports as follows:

Phase (a.): Technical Report No. 3, Section 4.1.

Phase (b.): Technical Report No. 2, Section 3.2 and Technical Report No. 3, Section 4.2.2.

Phase (c.): Same as (b.).

Phase (d.): Technical Report No. 2, Section 3 and Technical Report No. 4.

Phase (e.): Technical Report No. 1 was of a purely theoretical nature and is obsolete in that all related derivations are simplified and included in Section 3 of Technical Report No. 3 or elsewhere. Phase (e.) includes Technical Reports Nos. 2 and 3.

Phase (f.): All results of work on electrokinetic hydrophones are summarized in Technical Report No. 4.

The number of experimental hydrophones of each type which were constructed has been previously mentioned.

The work may also be summarized by referring to the principal section headings in the technical reports:

Technical Report No. 1.

"A Generalized Theory Regarding the Conversion of Energy by Electrokinetic Means". February 1952.

1. Introduction
2. Basis of Theory
3. Derivation of General Equations
4. Discussion of Equations for Single Capillary
5. A Note on Electrophoresis
6. The Electroviscous Effect in Small Capillaries
7. Relations Applying to Porous Plugs or Discs
8. Equivalent Circuits
9. Summary and Conclusions
10. Appendix

Technical Report No. 2.
"Properties of Electrokinetic Transducers". December 1952.

1. Introduction
2. Principles of Operation
3. Properties of Electrokinetic Transducers
4. Factors Determining the Suitability of Electrokinetic Transducers for Various Applications
5. References
6. Definitions of Symbols.

Technical Report No. 3.
"Properties of Electrokinetic Transducers". July 1953.

1. Introduction
2. Historical Background
3. General Theory of Operation
4. Electrokinetic Properties of Certain Liquids and Solids
5. Equivalent Circuits
6. Conclusions and Suggestions for Future Investigations
7. References
   Appendices

Technical Report No. 4.
"Electrokinetic Hydrophones". February 1954.

1. Introduction
2. Summary and Conclusions
3. Measurements with a Sealed Transducer
4. The LF-1 Hydrophone
5. The LF-2 Hydrophone
6. The S-2 Hydrophone
7. References
8. Appendix
   - A. Design and Performance Relationships with Alignment Charts
   - B. Self-Noise at Low Frequencies
   - C. Transformer Notes

3. CONCLUSION

Technical Report No. 4 covers the concluding phases of the work and presents test results on electrokinetic hydrophones obtained by the Underwater Sound Reference Laboratory. It is being distributed in a bound form, and is in effect the final technical report. This summary is being distributed to comply with the contractual requirements for a final report and will serve as an index for the project.

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